HONOLULU
LA JOLLA
MONTEREY
TIBURON

SOUTHWEST FISHERIES CENTER

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HONOLULU LABORATORY
Honolulu, Hawaii

INSULAR RESOURCES INVESTIGATION

Fisheries Habitat Planning Workshop Completed

Dr. George W. Boehlert, Chief, Insular Resources Investigation, convened an interagency task force at the Honolulu Laboratory (HL) on June 27-28 to plan the direction of the new Fishery Habitat Research Program for the next five to six years. The meeting was facilitated by David J. Mackett, Planning Officer for the SWFC; participants included: Henry Sakuda (Director, Hawaii Division of Aquatic Resources), Dr. Craig McDonald (Hawaii Department of Planning and Economic Development), Dr. James D. Parrish (Hawaii Cooperative Fishery Research Unit, UH), Eugene Nitta (Western Pacific Program Office, Southwest Region (SWR), Ted Hobson (Tiburon Laboratory), John F. Carr, (Deputy Director, SWFC), A. Dean Parsons (Office of Resource Investigation, Washington, DC). Participating from Honolulu Laboratory were: Richard S. Shomura (Director) and Drs. Boehlert, Jerry A. Wetherall, Stephen Ralston, and Jeffrey J. Polovina, and Paul L. Jokiel, Fishery Biologist. During the meeting, the participants listed the current and emerging issues in fisheries habitat preservation and habitat research in the central and western Pacific and identified those issues that fall into the purview of the Honolulu Laboratory mission. The group selected the major issues for which research and planning programs need to be designed. Research objectives were formulated and a plan was developed to meet these goals. The purpose of the planning and research effort is to provide the information needed to resolve the major habitat-related problems identified by the group. Major fishery habitat issues identified by the task force were: 1) effects of Ocean Thermal Energy Conversion (OTEC) projects, 2) effects of ocean mining, 3) need to establish a habitat inventory, 4) need for long-term baseline habitat research, and 5) need to evaluate mitigation as a method of offsetting habitat losses associated with human activity. Numerous related issues were included in the plan. These included problems such as the impact of dredge and fill operations, the identification and protection of nursery areas of economically important species, identification of habitat needs of threatened and endangered marine species, habitat-related causes of seafood poisons such as ciguatera, and the impact of major coastal construction projects. A report on the findings, recommendations, and proposed plan of action is in preparation. (G.W. Boehlert, FTS (808) 943-1221)

Habitat Aspects of OTEC Deployment at Kahe Point Examined

Dr. John T. Harrison, Fishery Biologist, has completed a preliminary draft of biological sections of an Environmental Impact Statement for a proposed Ocean Thermal Energy Conversion (OTEC) plant which is to be built at Kahe Point. Because a variety of elements of the nearshore marine environment affect recruitment, survival, and reproductive rates of fishery

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organisms, the effects of OTEC on fishery habitats may be of greater importance than direct effects on the species themselves. Harrison's assessments of potentially beneficial or deleterious effects of OTEC plant construction and operation are based on the interpretation and extrapolation of environmental and biological data from project engineering specifications for the OTEC plant.

As presently planned, the Kahe OTEC plant would irreversibly alter nearly 72,000 m^2 of the marine substratum inside the 100 m depth contour. As a consequence of the OTEC plant, more than 90% of the total affected area would be an open sediment. Thus, one major beneficial by-product of the OTEC development would be the creation of extensive hard substratum for colonization by coral reef communities. The biota attracted to the OTEC structures are expected to significantly enhance local recreational fisheries. However, further research is needed to predict rates and extent of community development and to understand synergistic effects of biota attraction on biomass loss at plant intakes.

Operationally, the major habitat alteration caused by the proposed Kahe OTEC facility would be the removal of over 100 $m^3\ s^{-1}$ of shelf water from the nearshore environment and the displacement of nearly the same amount of cold, deep water to the mixed discharge depth of roughly 100 m at the shelf edge. Due to the small size of the impact relative to the area of the biota source, entrainment and impingement losses are not expected to significantly affect fishery populations. However, without further study of egg and larval distributions and nearshore water circulation, accurate predictions of the impact on downstream population resulting from OTEC operation are not possible.

Accidental spills of either working fluid (ammonia) or biocide (chlorine) pose the most serious potential threat to nearshore fishery habitats. Results of modeling studies suggest that a major spill of either ammonia or chlorine would produce toxic plumes of sufficient extent and persistence that would endanger coral reef communities along the entire Waianae coast. However, because there are no data on chlorine or ammonia toxicity to Hawaiian nearshore biota and only sparse data on the kinetics of chlorine in oligotrophic subtropical waters, reliable assessments of the impacts of a major spill cannot be made. (G.W. Boehlert, FTS (808) 943-1221)

Potential Thermal Effects of OTEC on Larval Fishes Studied

Dr. George Boehlert and research assistant Yara Lamadrid-Rose completed work on potential thermal effects on early life history stages of tropical marine fishes. This work is being conducted to determine how fish in the egg, larval, and juvenile stages will be affected when they are exposed to lowered temperatures as a result of an Ocean Thermal Energy Conversion Plant. Boehlert and Lamadrid-Rose constructed a time course of cold shock based on a simulation of changes in water temperature from the planned Kahe Point OTEC plant. Experiments were designed to allow testing of different early life stages of tropical fishes at various exposure times (8, 16, and 24 min) and temperatures (5°, 10°, and 15°C, delta T).

Eggs and yolk sac stage larvae were tested for mahimahi, Coryphaena hippurus, and manini, Acanthurus sandsvicensis. Generally, eggs in earlier stages were more sensitive to temperature shock (i.e., mortality increased with increasing delta T as compared to controls). Exposure time, however, did not exert a significant effect. Significant excess mortality for all stages of eggs occurred at the range of times and temperatures proposed in current OTEC engineering plans.

For mahimahi larvae, excess mortality increased with age to values higher than for latest stage eggs, but this is believed to be caused by stress associated with yolk exhaustion. Juvenile striped mullet, Mugil cephalus, were also tested. Fish of a single size range were exposed to the same experimental protocol as the eggs and larvae. Although exposure time was not significant, delta T's of 15°C resulted in significant mortality, and there was a significant interaction between exposure time and delta T. This highest delta T tested is above that planned for the plant.

Sublethal effects of thermal shock were determined by considering the effects of "predation" upon yolk sac stage larvae of mahimahi. Newly hatched and day 1 posthatch larvae were exposed to three delta T's for three exposure periods, at two levels of simulated predation exposure with and without a 1-h recovery period. Generally, excess mortality was greater without a recovery period, for the earlier stage, at higher delta T and in the greater "predation" pressure. This suggests that entrained larvae might suffer sublethal effects as well as the direct thermal effects of mortality. (G.W. Boehlert, FTS (808) 943-1221)

Turtle Habitat Study Underway

George H. Balazs, Zoologist, has been working with the staff of the Fisheries Habitat Program on research to acquire baseline data on the dependencies and interrelationships of the herbivorous green turtle, Chelonia mydas, to its habitats at select sites in the main Hawaiian Islands. Nearly all reproduction in Hawaii by this migrant breeder occurs at French Frigate Shoals. During the nonreproductive periods, the greatest portion of its life, adults as well as individuals in the immature age classes reside in nearshore waters of the main islands. Emphasis is being placed on characterizing what constitutes good resident habitat for foraging, shelter for resting, and thermoregulation. The similarities and differences of various habits are being identified, along with the turtles' tolerance and adaptability to different types of habitat alteration which result from human activity. This research will help biologists evaluate actual or proposed habitat alteration.

The principal sites where studies are under way include Kawela Bay on Oahu, an area scheduled soon for substantial resort development; Palaau on Molokai, where introduced mangroves have significantly altered the coastline; Kahului Bay on Maui, where warm water is discharged from a power plant; Keomoku on Lanai, a relatively pristine area where heavy commercial turtle fishing took place during past years; and Polihua on Lanai, where abundant nesting occurred up to 50 years ago. These study sites were selected on the basis of their present or past importance to turtles, based on interviews with local residents and historical documentation in the

literature. Scuba and tangle nets are being used extensively to sample turtles for size frequency, abundance, food sources, sex ratios, and status of health. The turtles are captured and released a short time later after they are tagged with alloy flipper tags.

Hawaiian green turtles of all sizes greater than 35 cm carapace length feed on select benthic algae (Pterocladia, Acanthopora, Ulva, and Codium) that grow in shallow water, often in the intertidal zone. The turtles graze principally at night. They rest under ledges with soft sand or mud bottoms in deep water, frequently at the 18 m or more drop-off that exists a short distance from shore around all the main Hawaiian Islands. Resident habitats preferred by turtles are not evenly distributed, but rather are found at specific places where food and acceptable shelter are close by. Recent fishing pressure on this species that matures slowly also appears to have affected the distribution and numbers of turtles. (G.W. Boehlert, FTS (808) 943-1221)

Snapper-Grouper Workshop Held in Honolulu

Dr. Jeffrey J. Polovina, Leader, Resource Assessment Investigation of the Mariana Archipelago (RAIOMA) Program, and Dr. Stephen Ralston, Fishery Biologist, convened a 3-day workshop (May 20-22) on the biology and fishery management of snappers and groupers in the southeastern U.S., Gulf of Mexico, southeast Asia, Australia and across the tropical Pacific. Due to some differences in species composition, habitat, and fishing gear, much of the research and management for these stocks is region specific. The purpose of the workshop was to examine the biological and management aspects of this resource and to identify resource specific rather than regional specific relationships. Polovina and Ralston identified biological and fishery topics to be addressed and invited researchers with acknowledged expertise in that area to prepare papers on an assigned topic for presentation at the workshop. The papers presented at the workshop will be published in 1986 by Westview Press in a volume entitled "The Biology and Fishery Management of Snappers and Groupers in the Tropics."

During the snapper and grouper biological reviews session, Gerald Allen, Western Australia Museum, Perth, Western Australia; Bill Anderson, College of Charleston, Charleston, South Carolina; and John Randall, Bishop Museum, Honolulu, Hawaii, spoke on taxonomy. Those who spoke on reproductive biology were: Churchill Grimes, Rutgers University, New Brunswick, New Jersey; and Douglas Shapiro, University of Puerto Rico, Mayaguez, Puerto Rico. Jeffrey Leis, The Australian Museum, spoke on Early Life History, Charles Manooch, NMFS, SEFC, Beaufort, North Carolina, spoke on growth, Stephen Ralston, NMFS, SWFC, Honolulu, Hawaii, on mortality, and Dr. James Parrish, Hawaii Cooperative Fishery Research Unit, University of Hawaii, on Community-Trophic Interactions; Under Snapper-Grouper Experience Papers, Keith Sainsbury, Commonwealth Science and Industry Research Organization, spoke on assessment and management in Australia, Jeffrey J. Polovina, NMFS, SWFC, Honolulu, Hawaii, discussed assessment and management in Hawaii and the Marianas; Gene Huntsman and Jim Waters, NMFS, SWFC, Beaufort, North Carolina, discussed assessment and management in southeast U.S.; Scott Bannerot, Joe Powers, and Bill Fox, NMFS, SEFC, Miami, Florida, talked on assessment and management in the Gulf of Mexico and the Caribbean; Samuel G. Pooley, NMFS, SWFC, Honolulu,

Hawaii, discussed economics in a Pacific Island fishery; and Workshop Synthesis and Directions for Future Research was discussed by John Munro (Townsville, Australia), ICLARM. (J.J. Polovina, FTS (808) 943-1221)

Age and Growth Study on Mahimahi Completed

James H. Uchiyama, Fishery Biologist, and Raymond K. Burch and Sidney A. Kraul, Jr., of the Waikiki Aquarium have completed a manuscript on a study of the age and growth of mahimahi, Coryphaena hippurus, from around Hawaii. This study was based on mahimahi of known age maintained at the Waikiki Aquarium and the Kewalo Research Facility. The biologists found that it was possible to validate the ageing method covering the formation of the first daily growth increment (DGI), and the formation of DGI throughout the life of the fish and during periods of stress. For mahimahi, they determined that the first DGI formed on the first day posthatch and through the first 261 days of life. They also found that there was no loss of DGI during spawning, which was determined by examination of the sagitta of a known-age female mahimahi which had been spawning every other day for 2 months at the Waikiki Aquarium. The means of 10 direct counts by two independent readers, 260.1 and 262.0, agreed with the known age of 261 days. Therefore, it appeared that the stress of spawning every other day for 2 months did not affect the formation of DGI. Validation will continue as older, known-age specimens and other known-age spawners become available.

Also of interest was the rapid growth rate of mahimahi (Figure 1). A male mahimahi is estimated to grow 126 cm (fork length) and 20 kg in its first year of life. Similar growth rates have been observed in wild mahimahi specimens off Taiwan and specimens in captivity elsewhere. The mahimahi reached sexual maturity and began spawning in its 4th month of life. This fast growth rate is highly desirable for aquaculture species; other agencies in Hawaii are pursuing work on this species for aquaculture. (J.H. Uchiyama, FTS (808) 943-1221)

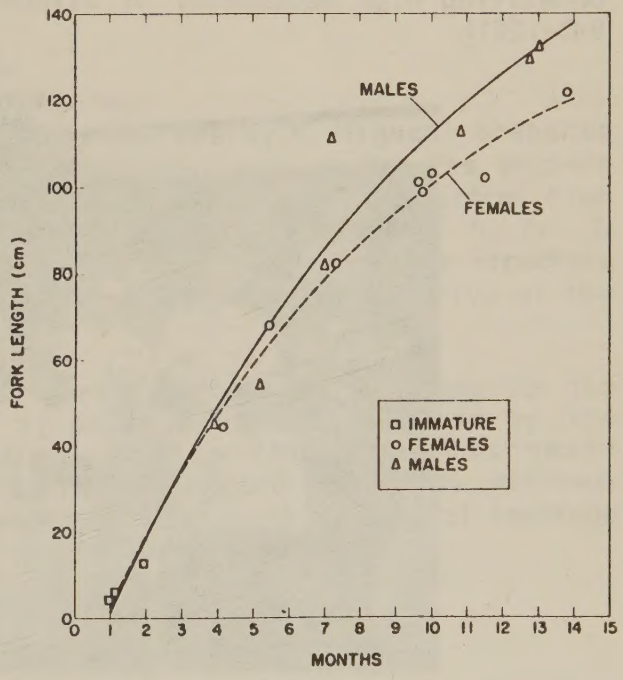

Figure 1. Growth curves of male and female Coryphaena hippurus in Hawaiian waters.

FISHERY MANAGEMENT RESEARCH PROGRAM

Data Collected on Domestic Lobster Vessels

Honolulu Laboratory personnel recently returned to Honolulu after making observations on domestic vessels fishing in the Northwestern Hawaiian Islands (NWHI) spiny lobster fishery. Research assistant Roy L. Bendell returned after 30 days of collecting data from a vessel fishing on Maro Reef, and research assistant Victor C. Honda returned from over 60 days at sea on another vessel that fished several banks. The observers collected data for the conversion of the minimum carapace length to the new tail width size regulation for the spiny lobster fishery. Preliminary analysis of the data (female and male combined) collected by Bendell indicates that the slope of the relationship between carapace length and tail width of spiny lobster is statistically the same as that calculated earlier for data collected on a cruise of the Townsend Cromwell. However, the adjusted means are statistically larger than those calculated from the Cromwell cruise.

The fishing vessel Lusty returned to Honolulu in late June with about 75% of the slipper lobsters required for experiments that are related to the NWHI spiny lobster fishery. The Laboratory experiments scheduled will evaluate the placement in lobster traps of the 55 x 280 mm escape vents. The 55 mm vent was chosen as best for retaining legal spiny lobster, but permitting high escapement of slipper lobster. (R.A. Skillman, FTS (808) 943-1221)

Top row, left to right: John Randall, Charles Manooch, Keith Sainsbury, Bill Anderson, Gerald Allen, Jeffrey Leis, John Munro, Stephen Ralston. Bottom row, left to right: Douglas Shapiro, Scott Bannerot, Jim Waters, Gene Huntsman, Joe Powers, Jeffrey Polovina.

Trends in the Spiny Lobster Fishery Described

Dr. Robert A. Skillman, Leader, Fishery Management Research Program, described recent trends in the NWHI spiny lobster fishery at a seminar at the Honolulu Laboratory. In 1985 the importance of spiny lobster in the fishery continued to decline, while the importance of slipper lobster has risen. Slipper lobster is now the dominant species in the catch (95,400 slipper lobsters versus 30,000 spiny lobsters were reported caught through May). The catch-per-unit-effort statistics show similar trends, and it is apparent that the fishermen are changing their fishing strategy in response to changes in the fishing grounds. The relationship between catch and trap-nights for 1985 differs considerably from that for 1983 and 1984.

A time-series analysis of catch per trap-night data from the fishery shows some interesting trends. For legal size spiny lobster, there is a declining long-term trend as well as a 26- and 13-month cycle. The 26-month cycle seems to represent a change in catchability since the fleet changed over from two-chambered wire traps to Florida wooden slat traps, and then to single-chambered black plastic traps. The 13-month cycle is, of course, the usual seasonal cycle, but there are cycles of 4, 9, and 3 months, which are less important. Fishermen report that there seems to be a positive long-term trend, but it is not significant. A cycle of 26 months was also found as well as one of less strength for 9, 5, and 13 months. The catch rate for berried females was very uniform in distribution. (R.A. Skillman, FTS (808) 943-1221)

Hawaii Bottom Fish Landings Summarized

Research assistants Jimmy R. Baxter and Wesley K. Higuchi prepared summaries, charts, and graphs of 1984 opakapaka landings for the Western Pacific Regional Fishery Management Council's (Council) bottom fish planning team. These data supplement those reviewed earlier by Dr. S. Ralston in an administrative report and indicate that the size structure used in that paper (based on 2-month landings) was representative of the entire year.

Also completed was a summary of overall bottom fish landings for the first five months of 1985 (Table 1) based on data collected by the Council's market sampler. Landings in the NWHI have increased substantially over a similar period during the record 1984 year, although landings from the main Hawaiian Islands are down slightly. Total landings are up about 10%. (R.A. Skillman, FTS (808) 943-1221)

Table 1. Hawaii bottom fish sales through May 31.

	1985	1984
Total pounds	495,911	448,119
Main Hawaiian Islands	281,925	296,464
Northwestern Hawaiian Islands	213,986	151,655

PELAGIC RESOURCES INVESTIGATION

Standard Metabolic Rate Experiments Completed

Dr. Richard W. Brill, Leader, Tuna Behavior and Physiology Task, has completed a series of experiments designed to directly measure the standard metabolic rate (SMR) (energy demand at zero overt muscular activity) of aholehole, Kuhlia sandvicensis, and rainbow trout, Salmo gairdneri. These data are to be used for comparison with similar SMR data obtained earlier on tunas using essentially identical methods. (The SMR is an essential parameter in many models of tuna energetics, age and growth, and natural mortality). The objective of these experiments was to test the suitability of the techniques used to measure the SMR of tunas by obtaining data on species (trout and aholehole) whose SMRs have been determined by the more common method of extrapolating a swimming speed-metabolic rate curve back to zero swimming speed. It is currently not feasible to use this more common technique to determine the SMR of tunas.

Preliminary analysis of the data indicates that the methods used to directly measure SMR give essentially identical values to those obtained by extrapolation of swimming speed-metabolic rate curves. (R.W. Brill, FTS (808) 943-1221)

Two Yellowfin Tuna Successfully Tracked

Two yellowfin tuna tagged with ultrasonic depth sensitive transmitters were successfully tracked for 12 and 38 hours on the research vessel, Kaahele'ale. This tracking project is a joint effort with Dr. Kim Holland of the Hawaii Institute of Marine Biology and is jointly supported by the Honolulu Laboratory, University of Hawaii Sea Grant Program, and the State of Hawaii. The first fish was caught immediately adjacent to fish aggregating device (FAD) "S" located off the Waianae coast of Oahu. It remained in the immediate vicinity of the FAD for approximately 5 hours and then slowly moved offshore. Unfortunately, the track had to be abandoned after 12 hours due to mechanical problems with the boat's engine.

The fish was 74 cm (fork length) and was the largest tuna tracked by project scientists to date. Although its horizontal movements were similar to those of other yellowfin tuna tracked in this area, it remained at significantly greater depths than the smaller yellowfin tuna. These data seem to support the heat production-heat loss models for yellowfin tuna which predict that larger fish must remain in cooler water to avoid overheating.

A second, smaller yellowfin tuna (56 cm fork length) was tracked for 38 hours. This fish was caught near the 50 fathom isobath, which is several miles inshore of the local FADs. Similar to other previously tracked yellowfin tuna, this fish patrolled along the isobath during the day but moved offshore during the night, and it returned to the isobath again at dawn. In contrast to the larger fish tracked just 2 weeks earlier, this yellowfin tuna completely ignored the four FADs that were easily within its range.

In addition to providing replicate data on diurnal movements, this fish also provided high quality data on sustained swimming speeds. During one phase of the track the fish swam a very straight course for over 5 hours at approximately 3-4 body lengths per second. (R.W. Brill, FTS (808) 943-1221)

DATA MANAGEMENT AND TECHNICAL SERVICES

Improvements Made in Communications Capabilities

Significant improvements have been made during the past two months in communications capabilities between the Honolulu Laboratory and external computer systems. Twelve hundred bps asynchronous data can now be transferred reliably via telephone lines between the Honolulu Laboratory and the University of Hawaii, the La Jolla Laboratory, and Southwest Region offices in Los Angeles and Honolulu. File transfer between the HL Molecular computer system and the UH IBM 3081 and DEC-20 systems is accomplished using the KERMIT software package. Communications with the Molecular computer system at the La Jolla Laboratory is accomplished using MODEM7 and with SWR IBM PC computers using Cross Talk. All of these systems provide sufficient error checking to ensure complete and reliable file transfers. (F.V. Riggs, FTS (808) 943-1221)

Software Developed to Check and Edit Data

Fred R. Frizelle, Computer Programmer, has completed a software system to check and edit Hawaiian monk seal census data being collected in the NWHI. This system, which has been under development on the Mohawk computer system since November, will handle all aspects of monk seal data preparation from the data entry stage, through numerous error-checking and restructuring routines, to a very reliable data base. Since the data represent, among other things, observations on interactive behavior between seals, the software system required a more sophisticated method of checking than is normally required with fisheries data to ensure that interactions were properly coded and recorded for all participants in the interaction. Frizelle is now developing system-wide documentation which will help the staff of the Marine Mammals and Endangered Species Program analyze the data. (F.V. Riggs, FTS (808) 943-1221)

Results of In-house Questionnaire Analyzed

A software usage questionnaire was distributed in May to all HL computer users at the Honolulu Laboratory to identify new software needs and determine the usage frequency of currently available software. User responses indicated needs in the areas of data analysis, graphics, and training in the use of existing software. In response, the HL has initiated the procurement of four IBM PC/AT computers to serve as "satellite" systems to provide the needed increased capabilities in processing powerr and graphics display. In addition, software training

needs are being addressed in-house through the use of a "lab experts" reference list and more thorough software documentation, as well as individual consultation and group training classes. (F.V. Riggs, FTS (808) 943-1221)

COASTAL FISHERIES RESOURCES DIVISION
La Jolla, California

COASTAL EASTERN PACIFIC POPULATION BIOLOGY OF FISHES

Workshops on Tuna Movement Dynamics Completed

As a result of recommendation of a report of an international meeting, "considerations for Tuna Research to the year 2000," a series of four workshops were held at the SWFC over the past year to conceptualize the problems of tuna movements and distribution, and to define specific research projects and experimental designs for the study of tuna movement dynamics. These workshops, supported jointly by the Inter-American Tropical Tuna Commission and NMFS and chaired by Dr. John Hunter, have been completed and a first draft of a final report of the transactions of the four workshops will be written July 29 to August 2 by the panel members who attended all workshops. Recommendations that may be included in the report (Future Directions for Research on the Dynamics of Tuna Movements) are the establishment of an international file for tuna tagging data; linking international oceanographic programs to tuna movement dynamics; development and use of an archival tag which indicates position; and field studies on mechanisms of tuna movement that combine oceanography, mark-recapture, new technologies for assessment of the physiological state of tunas, sonic tracking and release of archival tags. (J. Hunter, FTS 893-6220)

COASTAL EASTERN PACIFIC FISHERIES ENVIRONMENTAL INVESTIGATIONS

Outlook for 1985 U.S. Albacore Fishery Issued

The forecast for the 1985 U.S. albacore fishery was issued by Center Director Izadore Barrett on June 13. The forecast was prepared by the staff of the Fisheries Environmental task under the leadership of Dr. R. Michael Laurs. The forecast, which is based on the results from research on albacore, has been issued by the SWFC since the early 1960s.

Although large numbers of albacore arrived earlier than normal during the past two seasons, it is expected that the time of arrival this year will be more like that of a traditional albacore fishing season. The main bodies of albacore are expected during late June to early July off southern California, and about late July off the Pacific Northwest. The outlook for the 1985 U.S. albacore fishery is generally good.

South of Point Conception, albacore fishing will probably continue later this year than in the past 2 years, when fishing dropped off drastically during August due to warm water conditions. Ocean condition should continue to be favorable for catching albacore this year through the fall months. Sportsfishing for albacore should be very good this year, although it is not expected to match record catches made last year.

Between Point Conception and Cape Mendocino, albacore fishing should be good again this year. Moderate amounts of upwelling occurred during April-May, which should result in moderately good feeding conditions and development of temperature and water-color boundaries.

In waters north of Cape Mendocino, albacore fishing is expected to be much improved over what it was last year. Good fishing conditions will probably occur in the area about 1000-1500 miles offshore between northern California and southern Washington about early August, and fishing within a few hundred miles of the coast will be much improved this year over what it has been for the past several years.

After more than 2 years of warmer than normal ocean temperatures associated with the recent El Niño, sea surface temperatures (SST) have returned to near normal along much of the west coast of North America. The near-normal SST conditions indicate that there has not been any unusual persistence in storm patterns or significant alterations in surface flow characteristics. Seasonal warming has occurred at normal rates. In April and the first half of May, 1985, SST's deviated less than 1°F (0.5°C) along the entire coastal zone east of about 130°W longitude from Vancouver Island to Baja California. Offshore of about 132°W longitude there is a tendency for slightly higher than normal temperatures. Mixed layer depths to the top of the thermocline have also returned to about normal along much of the coast. For example, off southern California during March 1985 these depths ranged from about 100 to 250 feet compared to depths in 1984 which were as much as three times greater.

Since the beginning of 1985, the index of wind-driven coastal upwelling has been close to its seasonal average values. In the average seasonal progression, coastal upwelling increases from very low values, or downwelling during winter, to peak upwelling in late spring and summer. Upwelling is strongest along southern California in late May, along central California in June, and in the Pacific Northwest in July. Upwelling provides nutrient enrichment to the near surface water. As the result of the nutrient enrichment there is a build-up through the food-chain, ultimately leading to growth and aggregation of forage animals for albacore. While in some years the upwelling index has shown considerable variation, its near-average values this year suggest average conditions for albacore forage organisms and the development of upwelling fronts or boundaries where albacore tend to concentrate.

The staff of the Fisheries Environmental Task at La Jolla will issue albacore fishery advisory information throughout the 1985 season. The advisory information will include biweekly albacore fishing bulletins which are mailed to interested fishermen, and daily broadcasts of albacore fishing information which are transmitted over marine and commercial radio bands. The broadcasts will be made twice daily on week days and once on Saturday mornings from July 8 through October 18 or until the season ends. Nearly cost-wide reception of the albacore fishery advisory broadcasts will be available again this year. (M. Laurs, FTS 893-6276)

ECOLOGY AND TAXONOMY OF FISHES, CalCOFI

CalCOFI Ichthyoplankton Data Base Developed

The staff of the Ecology and Taxonomy of Fishes program continued to develop a computer data base for the historical CalCOFI records of ichthyoplankton taken during the past 35 years. This project, which is a collaborative effort with computer programmer Richard Charter and fishery biologist Paul Smith, began with coding of the various fish species on the original identification sheets. A staff of biologists with special competence in identification of larval fishes of the California Current region corrected errors and inconsistencies and entered the corrected information into a computer data base where the original identifications were completed with computer listings. The corrected printouts were compared with an independent summary file.

During the final editing process, Smith and his staff produced geographic and seasonal summary plots for all of the fish species. From these, Dr. Geoffrey Moser, leader of the program, identified erroneous data and "outliers" (aberrant distribution) which required further checking. The specimens collected in the original plankton samples were each examined by fishery biologists David Ambrose, Morgan Busby, Barbara MacCall, Elaine Sandknop, and Betsy Stevens, and the data base corrected.

This work, which requires the most careful and painstaking efforts, is nearing completion for those plankton samples taken during the years 1954-1960, while preliminary editing has been completed for all years to 1969. (G. Moser, FTS 893-6239)

Sanddab Larvae in CalCOFI Samples Identified

Identification of the larvae of the seven species of sanddabs (Citharichthys spp.) off California and Baja California has been a difficult problem. Barbara MacCall, Fishery Biologist, has now reexamined this problem and discovered a set of characters which permit the identification of most of the species. Using these characters the staff of Ecology and Taxonomy of Fishes has been reexamining all CalCOFI samples containing Citharichthys larvae from the 1954-1960 CalCOFI surveys and identifying the species. The results have been encouraging and all stages can be identified for sanddab species which occur off California. Some problems have been encountered in samples collected off Baja California, where differences in pigment patterns suggest that species of this genus exhibit variation not found elsewhere in CalCOFI shorefish larvae. Another possibility is that there may be an undescribed species of sanddab in Baja California waters. Resolution of this problem will require a thorough examination of adult sanddab collections. The data on larval snaddabs will be assembled in a report to be used as a basic document for a proposed project on sanddabs. (B. MacCall, FTS 893-6215)

Vertical Distribution of Fish Eggs and Larvae Studied

A study of the vertical distribution of eggs and larvae of northern anchovy and other species is in its final phase. The project is a cooperative effort of Dr. Tilman Pommeranz, Institut für Meereskunde, Kiel, West Germany, Dr. Geoffrey Moser and his staff, and other Coastal Division groups. Pommeranz was chief scientist for the research cruise and has continued work at the SWFC on a research scholarship awarded by the German Research Association.

For the study, two stations were occupied by Scripps Institution of Oceanography research vessel, Ellen B. Scripps, in March-April 1980 for about 10 days each. The first of these (CalCOFI station 90.2 35.8) was a deep-water station near Santa Catalina Island and the second (90.0 28.2) was a nearshore station at Dana Point. Different water layers were sampled from the surface down to about 400 m with various nets, including the Manta net, a multiple opening-closing ichthyoplankton sampler (Messhal), a CalCOFI Bongo net and an opening-closing Bongo net. Pump samples were taken each day to determine the nature of the chlorophyll maximum layer.

All fish eggs and larvae collected in the 460 samples were identified to the lowest taxon possible, and the embryonic stages of the anchovy eggs were determined. All anchovy larvae were measured in 0.5 mm length groups and all other fish larvae (OFL) were measured to 0.1 mm intervals. All biological and environmental information was used to establish a data base designed and installed on the VAX at UCSD under DATATRIEVE using indexed files. The biological data were adjusted to conform to other Coastal Division studies. For example, the disintegrated anchovy eggs and larvae as well as the disintegrated OFL were sorted and added to the numbers of the undamaged eggs and larvae.

Further adjustments were necessary for the anchovy data only. The numbers of anchovy eggs and larvae were corrected for extrusion based upon earlier work of mathematician Dr. Nancy Lo. The numbers of anchovy larvae in the 0.5 mm length groups were adjusted for shrinkage caused in the net and by fixation according to the methods of fishery biologist Gail Theilacker. Avoidance correction factors were established for anchovy larvae caught by the Messhal according to the methods of Drs. Paul Smith and Roger Hewitt.

Daily age groups were established for anchovy eggs and larvae. The egg data were processed by Lo who used an automated procedure developed for the egg production method. Age determinations for larvae were based on Lo's growth model for yolk-sac larvae and fishery biologist Richard Methot's model for post yolk-sac larvae. For selected post yolk-sac larvae, the age data predicted by the model were compared with age estimations based on otolith readings provided by fishery biologists John Butler and Susan Longinotti. Although the larvae appeared to grow slightly faster than predicted by the model, the data from the two methods are in close agreement and permit use of the model for this study. The available data base will now be used to produce a final report which will include the technical tow data, the environmental data, the anchovy egg and larval data and comprehensive statistical summaries on the vertical distribution of anchovy eggs and larvae. (G. Moser, FTS 893-6239)

COMMERCIAL AND RECREATIONAL FISHERIES RESEARCH FOR MANAGEMENT

Anchovy Biomass Is Estimated

The staff of the Coastal Fisheries Resources Division completed the northern anchovy spawning biomass estimate for 1985. The project was coordinated by Dr. Alec MacCall, and the estimate of the spawning biomass of the northern anchovy central stock has been required for defining optimum yield by Anchovy Fishery Management Plans developed by the Pacific Fishery Management Council since 1978. This year's biomass estimate was 521,000 metric tons, and the optimum yield for the stock will be 207,000 metric tons, including a 140,000 metric ton quota for the domestic anchovy reduction fishery.

Anchovy spawning biomass has been estimated by the Egg Production Method (EPM) since 1980. The EPM is a method of abundance estimation developed by the SWFC which computes the spawning biomass as the ratio of the number of eggs produced by the population per day (estimated from an egg survey) to the specific fecundity, which is the number of eggs produced per day per weight of spawning fish (estimated from histological examination of adults caught by trawling). (A. MacCall, FTS 893-6820)

Post El Niño Anchovy Behavior Provides Clues to Population Dynamics

The geographic distribution of anchovy eggs in February-March 1985 was much wider than has been seen at any time sine 1980, extending well over 200 miles offshore of southern California and far north-ward along the central California coast (Figure 1). Such a wide distribution was last seen in the early 1960s following the intense El Niño conditions of the late 1950s; the present wide distribution follows the intense El Niño of 1983, suggesting a possibly similar mechanism of oceanographic and behavioral interaction.

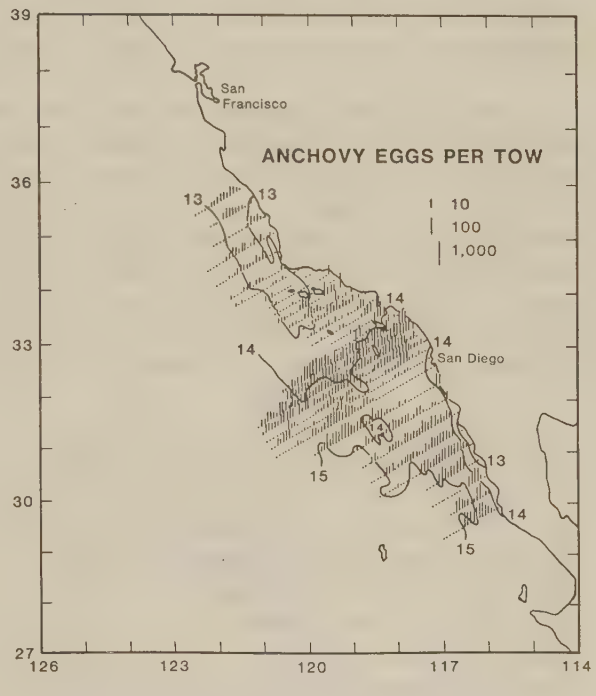

Figure 1. Anchovy egg distribution in February-March, 1985.

Physiological responses to El Niño also provide insights into anchovy population dynamics. Specific fecundity (see above) is a combination of batch fecundity, spawning rate and sex ratio, since it is an overall biomass-specific rate of egg production. Specific

fecundity during the peak season of anchovy spawning dropped to a low value (24 eggs/gram-day) in 1983 at the onset of the recent El Niño, jumped to a high value (42 eggs/gram-day) in 1984 toward the end of the event, and continues high this year at 37 eggs/gram-day (33 eggs/gram-day is the 6-year average). Clupeoid stocks such as the northern anchovy often have very shallow stock-recruitment relationships, i.e., the average surplus of recruits over the replacement level is small at all stock sizes. This indicates that persistent fluctuations of ± 20 to 30% in specific fecundity (as well as duration of spawning in a season and age of first reproduction), given similar probabilities of offspring survival, could cause large changes in equilibrium biomass and productivity of these stocks. Moreover, this source of changed stock productivity could not be detected by customary fishery monitoring, but only by the type of physiological observations done in the egg production method. (A. MacCall, FTS 893-6221)

Coastal Pelagic Fishery Status

Cynthia Thomson, Industry Economist, co-authored a Southwest Region Administrative Report entitled "The status of California's coastal pelagic fisheries in 1984" with Allen Grover, Biologist with California's Department of Fish and Game and Bill Craig, Biologist at the Southwest Region. This combined SWFC/SWR report replaces the two reports written last year, one for the anchovy fishery and one for the coastal pelagics. While it focuses mainly on the southern California purse seine fleet, the report covers the commercial fishery, the various management regimes, the live-bait harvests and recreational fisheries for the coastal pelagic species.

As in 1983, Pacific and jack mackerel dominate the catch (41,468 mt mackerel out of 48,388 MT total) and revenue ($8.2 million from mackerel out of a total $14.7 million) of the southern California purse seine fishery. Since the collapse of the domestic reduction fishery due to competition from other sources of fish meal, anchovy fishing is now essentially a live-bait fishery. No squid and only a moderate 2,647 MT of bonito was landed by the southern California fleet in 1984. One positive development for the purse seiners was the unusually large catch of tuna, accounting for $5.6 million in revenue. (C. Thomson, FTS 893-6209)

Contractor Chosen for BASES Study

A technical evaluation committee consisting of Dan Huppert, Sam Herrick and Cynthia Thomson (SWFC) and Chuck Korson (SWR) has completed its evaluation of proposals for the Bay Area Socio-Economic Survey (BASES). The data from BASES will be used to estimate the economic value of recreational fishing in the San Francisco Bay area. The contract awarded to CIC Research, Inc. of San Diego. Huppert and Thomson have met with representatives of CIC to discuss the timetable and other details for implementation of BASES, which is scheduled to begin in late August. Before beginning the survey CIC and SWFC personnel will finalize the survey forms and procedures. (D. Huppert, FTS 893-6261)

OCEANIC FISHERIES RESOURCES DIVISION
La Jolla, California

MARINE MAMMAL ASSESSMENT INVESTIGATIONS

Cast System Used to Measure Distance from Ship to Marine Mammals

Dr. Rennie Holt, Operation Systems Analyst, conducted field tests aboard the NOAA Ship David Starr Jordan to investigate the use of the computer-assisted sighting technique (CAST) system to improve accuracy of measuring the perpendicular distance of a marine mammal school from the ship's trackline. The perpendicular distance is used by observers to estimate dolpin population sizes. The distance is calculated by using the sighting angle and radial distance estimates. The CAST system records sighting angles to targets and calculates estimates of radial distance by triangulation using successive angle measurements and the distance traveled by the ship between the two angles. Cast also corrects angles to account for pitch, roll, and yaw of the ship. The procedure requires the ship to maneuver at least once to collect data in at least two directions.

During a typical tracking sequence the ship approached the target at a constant speed and at a specified angle. The ship maintained the initial course for a preselected time, and then turned to a second course for a preselected time. A third leg was completed during some runs. Fourteen tracks were completed using buoys as targets to determine the optimal values for several parameters in algorithms used by CAST to calculate distance.

Using these optimal values, six tracks were completed using the ship's speedboat as a target to simulate different orientations of a moving target (i.e., marine mammal schools) to the ship. The boat maintained a constant speed and course during the tracking sequence. For each track of the speedboat (Figure 1), the percent difference between the estimate of radial distance determined by the CAST system and the distance read from radar was calculated. During each track, the initial position of the target was approximately 80 degrees off the port bow.

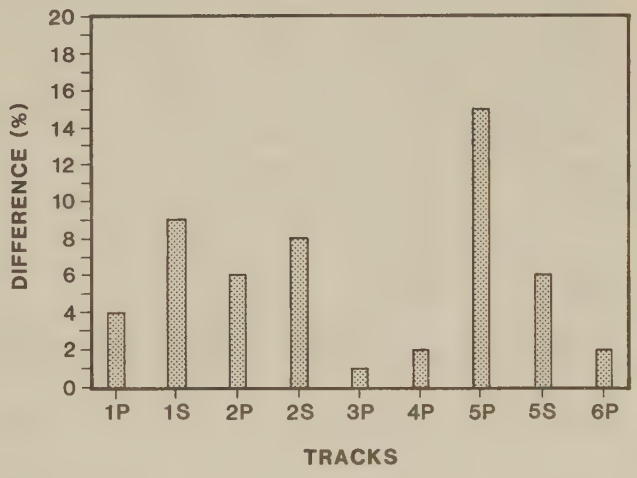

Figure 1. Percent difference between estimates of radial distance from AST system and from radar during six tracks of the ship's speedboat. S and P denote difference calculated using starboard and port binoculars, respectively.

The degree of accuracy of the estimates observed in this study is encouraging. Additional data, needed to confirm that CAST correctly calculates distance, will be collected using target boats at greater radial distances and using buoys during rougher sea conditions. (R. Holt, FTS 893-6276)

TUNA ASSESSMENT INVESTIGATIONS

Ninth North Pacific Albacore Workshop Held

The Southwest Fisheries Center hosted the 9th North Pacific Albacore Workshop at La Jolla, California, from May 15 to 17. Eighteen scientists from Japan, Canada, and the United States attended the workshop to discuss results of stock assessment, mathematical modeling, biology, tagging, ocean fisheries interactions, and data compilation and exchange. A total of 28 working documents and several oral presentations were made to the group.

The participants concluded at the end of the workshop that the condition of the North Pacific albacore resource is stable; the current annual catch is approximately 60,000 metric tons. Catch per unit effort of the major fisheries appears to be stable or increasing. This follows a decline after peak catches in the first half of the 1970's of about 120,000 metric tons. The average size of fish taken in each of the major fisheries over the year has remained approximately the same. (N. Bartoo, FTS 893-6244)

Catch Per Effort Indices Reviewed

Dr. David Au is preparing a review of catch per unit of effort (CPUE) indexes obtained from longline fisheries (e.g., catch/100 hooks). The purpose of the study is to determine if systematic biases exist in such indexes, due to, for example, deterioration of bait on the hooks that increases as the time that the bait soaks in the water increases. The theory of random encounters of fish with gear (or vice versa) is implicit in all treatments of the problem, and has been discussed in terms of fishing theory and search theory in operations research. The basic equation relating relevant variables to longline catches was given by G. I. Murphy in 1960:

$$\text{Fish/hook} = \text{CPUE} = [b/(c-a-b)]\,[e^{-(a+b)t} - e^{-ct}] \qquad (1)$$

where a = instantaneous rate of catching of non-target fish (including lost bait etc.)

b = instantaneous rate of catching target fish

c = instantaneous rate of losing already caught target fish.

Another form of this relationship relates the crude rate of fishing (= reported catch/100 hooks) to the net rate, or corrected CPUE, which is the rate that would be obtained if other competing species were not present. The net rate is:

$$\text{Net CPUE} = 1 - Q_0 ** [(Q_2+Q_3)/(1-Q_0)] \quad (2)$$

where Q_0 = empty hooks/100 hooks

Q_2 = hooks having caught target fish/100 hooks

Q_3 = empty hooks due to target fish escaping after being caught/100 hooks.

The relationship (2) was derived by B. J. Rothschild in 1967 (Rothschild did not include the term Q_3). He showed that at high catch rates of target fish, CPUE should underestimate the net CPUE rate because of competition for hooks. This effect would be exacerbated if Q_3 were involved and if Q_3 were large. However, at low catch rates there is little difference between the crude and net rates. The results from examination of equation (2) do not consider changes in soak time, e.g. shorter times when catch rates are high and vice versa. Equation (1) shows how the (crude) catch rate is related to soak time. This kind of relationship has been called the "diffonential"; it is the difference between two exponential curves, and its form is similar to the log-normal distribution, i.e., a normal curve skewed to the right. The possibility that fishermen might systematically adjust soak times in response to changing catch rates (perhaps fishermen could fish using the best soak time) is being studied as a possible biasing factor in reported longline catch rates.

While crude CPUE rates underestimate the true or net CPUE when catch rates are high, all catch rates, including net CPUE, are further biased because each hook can catch only one fish. The catch rate on a longline set is therefore a frequency rate (this is a problem if the fish arrive in schools). To make frequency rates linear with respect to fish density (d), a relationship of the form:

$$D = \ln (1-\text{CPUE}) \quad (3)$$

should be used, although there is again little difference between CPUE and D if CPUE rate is small. J. G. Cooke and J. R. Beddington have recently discussed how CPUE is biased from relationship (3). (D. Au, FTS 893-8936)

Interactions Between Seabirds and Tunas and Dolphins Described

Dr. David Au and Robert Pitman have revised a manuscript describing the interactions of seabirds with tuna and dolphins, based on data they collected between 1976 and 1980. In the paper, they point out that seabirds are commonly associated only with spotted and spinner dolphins among the many cetaceans in the eastern tropical Pacific, that only these two dolphins are commonly associated with yellowfin tuna, and that this multispecies association is common only on the purse seine fishing grounds

of the eastern tropical Pacific. In the dolphin-associated bird flocks there are multispecies assemblages in which three species of boobies and frigatebirds are common. In contrast, bird flocks found in waters beyond the purse seine fishing grounds contain few species, are dominated by sooty terns, are associated with small, skipjack-like tuna, and are seldom associated with dolphins. The implications of these differences are discussed with respect to possible area-wide differences in prey and in the strategies for exploitation of that prey. (D. Au, FTS 893-8936)

Gardiner Foundation Billfish Tagging Awards Presented to Mexican-Charter Captains

James Squire, Fishery Biologist, recently participated in the awarding of prizes to recreational fishing boat captains and sponsoring resorts who tagged billfish off Baja California, Mexico. The waters off Baja California are among the world's prime sport fishing grounds for billfish. In recent years the billfish resource has also been fished heavily by commercial longline boats and concern has grown among sport fishermen over the abundance of these species in the future.

As part of his study of the biology and patterns of migration of billfish in recent years, Squire has coordinated a tagging program whereby sport fishermen tag and release billfishes they catch. The tagged fish are later caught either by commercial or sport fishermen and the tag is returned to the SWFC. As an incentive to local boat captains and resorts in Baja California, Mexico to participate in the tagging program, the Gardiner Foundation of Oakland, California, agreed in 1970 to fund cash prizes and plaques annually to boat captains and resorts who tag the largest number of fish.

The 1984 winners were determined by Squire. This month, Squire presented cast awards and plaques to the fishing boat captains and their sponsoring resorts at an outdoor ceremony held at Hotel Rancho Buena Vista located on the eastern shore near the southern tip of Baja California, Mexico. Also attending the award ceremony were 80 U.S. anglers, most of whom were from the Balboa Angling Club of Newport Beach, California.

Awards are given to the six leading captains. The winner for 1984 was Captain Antonio Vargas. Captain Vargas tagged and released 54 billfish, the greatest number among the 30 captains that competed. The fishing resort having the greatest number of billfish tagged is also given an award by the Gardiner Foundation. Hotel Rancho Buena Vista was again the winner of this award, and Mark Walters, owner of Rancho Buena Vista, accepted the award. (J. Squire, FTS 893-6376)

The six leading captains who received awards (from left to right) Antonio Vargas, Gilberto Castro, Victor Garcilla, Martin Fiol, Jesus Araiza, and Manuel Acevado. In the foreground are James Squire (left) and Mark Walters, owner of Rancho Buena Vista.

ECOLOGICAL FISHERY SYSTEMS INVESTIGATIONS

North Pacific Albacore Simulation Model Developed

Dr. Pierre Kleiber, Fishery Biologist, has developed a simulation model of albacore in the North Pacific. Albacore in the model mimic albacore in real life. They enter the model as young recruits (fish just big enough to be caught). Thereafter they grow, migrate about the north Pacific, and ultimately die from natural causes. They are also harvested by three model fishing fleets which represent the three principal real-life fisheries: the Japanese pole-and-line boat fleet, which operates mostly in the western half of the north Pacific; the longline fleet, which is mostly Japanese and operates throughout the north Pacific; and the United States jig fleet, which operates in the eastern half of the north Pacific.

Model development used revised dtaa on catch and effort for the Japanese fleets. These data, along with data on the U.S. fleet, have been used to derive values of various parameters of the model and to check the performance of the model.

Initial runs of the model have been based on data averaged over the 11 years of most reliable data in the data base, 1970 through 1980. The idea is to depict a typical year in the life of the albacore fisheries rather than a specific year. The total annual catch-at-size for each fleet in the model conforms well with the corresponding real data averaged over the years 1970 through 1980 (see Figure 1). Results will be examined by month and geographic area to try to resolve differences between the model and real data at that level of detail.

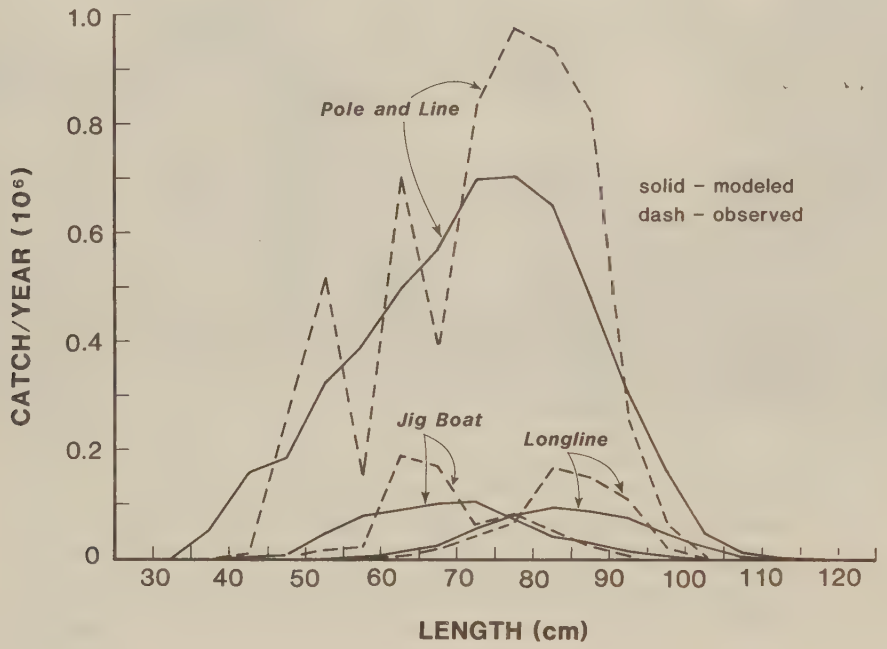

Figure 1. Observed and modeled albacore catch for average year.

The model has been used for a preliminary look at the degree of interaction among the fleets harvesting albacore in the north Pacific. Using the typical year as a basis of comparison, a series of model runs were made in which the effort level of one of the fleets was either doubled or halved, and changes in catch in each of the fleets noted. As expected, the most dramatic effect was always on the catch of the fleet with the altered effort level. The only significant interaction between fleets occurred with the doubling and halving of the pole-and-line effort, which resulted in a 20% reduction and 15% increase, respectively, in the longline catch. All other interactions were less than 5%. It should be emphasized that these are preliminary results based on a typical year during the decade of the 1970's.

To further investigate the behavior of the model, runs were made starting with no fish in the model except for a single pulse of recruits, with no subsequent recruitment. This procedure allowed the behavior of a single cohort of albacore throughout its lifetime to be investigated. To aid in this visualization, a short animated film of the graphical output from the model was made. The film shows the changing migratory behavior as fish grow from small recruits in the equatorial areas and move northward to join extensive annual east-west migrations, and then move south to the spawning grounds again when they reach adult size.

The rather primitive film helps to understand the complex behavior of the model. Animation techniques will be developed further and promise to be a good way for scientists and non-scientists alike to visualize and understand intricate results of simulation models and data analyses. (P. Kleiber, FTS 893-6294)

DOLPHIN MORTALITY-MONITORING SYSTEM CONVERTED TO LA JOLLA STANDARD MICROCOMPUTER

A computerized database system used to estimate dolphin mortality incidental to tuna fishing in the eastern tropical Pacific has been transferred to a microcomputer and delivered to the San Diego field office of the NMFS's South Region. The system developed at the Southwest Center and originally used there to estimate mortality was transferred from the UCSD VAX computer system to a La Jolla Standard microcomputer. Computer programmer analyst Ken Wallace coordinated the work; the actual conversion was done by contract programmers and by SWFC programmer Lily Tang.

Susan Boyer, contractor, developed a new interactive system of data entry/editing using the program dBASEII. The system simplifies and speeds up entering information pertaining to: 1) vessel departures and arrivals and 2) radio-reported dolphin kills as observed by technicians at sea. Another contractor, Celia Jacobs, converted several VAX-11 FORTRAN programs to SSS FORTRAN on the micro. These programs estimate kill using observe kill-per-day and the number of fishing days in the fleet. Lily Tang tested separate subprogram systems and combined them into a single system.

The system including the current 1985 database was delivered to the Southwest Regional field office in San Diego where estimates of mortality will now be made. (K. Wallace, FTS 893-6357)

PACIFIC ENVIRONMENTAL GROUP
Monterey, California

Research Paper Completed on Effects of Recent El Niño on Alta and Baja California

Jerry Norton, Douglas McLain, Rusty Brainard and David Husby, Oceanographers at the Pacific Environmental Group, have recently completed a research paper on the effects of the 1982-1983 El Niño off Alta and Baja California. The paper was based on an analysis of the large-scale sea temperature anomalies at the surface and subsurface levels over the California Current Region during 1982 and 1983. The paper, "The 1982-83 El Niño event off Baja and Alta California and its ocean climate context," will be published in "El Niño North: Niño effects in the eastern subarctic north Pacific" to be published by the University of Washington Sea Grant.

The oceanographers used the large data sets of subsurface oceanographic data available at the U.S. Navy Fleet Numerical Oceanographic Center. They summarized the subsurface temperature data for the 1971-83 on transects along latitudes 23.5, 33.5, and 40.5°N. Each transect consisted of lines of 3° latitude-longitude blocks extending about 3000 kilometers offshore. The anomalous warming that occurred along the coast in the winter of 1982-83 and summer of 1983 at the surface was also evident at 100 and 200 meters near the coast, but was accompanied by anomalous cooling in the region 1000 to 3000 km offshore from northern and central California. The analysis of monthly temperature anomalies at the various levels revealed some interesting results. The monthly anomalies during the winter of 1982-83 were greater at 100 m than at the surface and the persistence of warm anomaly below 100 m during the 1982-83 event suggests that oceanic propagation from the tropics is consistent with coastal Kelvin wave activity.

The principal source of subsurface oceanographic data at the Pacific Environmental Group is the Master Oceanographic Observations Data Set (MOODS), maintained at the U.S. Navy Fleet Numerical Oceanography Center, Monterey, California. This data set comprises virtually all U.S. and foreign oceanographic station data, mechanical bathythermograph (MBT) and expendable bathythermograph (XBT) data in the world's oceans. The real-time MBT and XBT reports received at FNOC are input to the MOODS file on a regular basis.

The oceanographic station data has been supplemented in the eastern boundary current regions by recent cooperative projects with visiting foreign scientists at PEG. Dr. Fernando Robles, now at IOC, Paris, provided the oceanographic data collected by the Instituto de Fomento Pesquero (IFOP) off the coast of Chile during the period 1964-74, about 2000 stations. Alan Boyd of the Sea Fisheries Institute, Capetown, South Africa, provided the oceanographic station data for 14 cruises during the 1971-73 period on a regular grid of stations off South West Africa.

The MOODS file has also been used to characterize the seasonal variability of the stability of the water column in the various eastern boundary currents. Summaries of the subsurface density profiles proved useful in the description of the Benguela Current system, where it was shown that although the peak spawning of the anchovy and sardine near Cape Agulhas occurred during a season characterized by strong turbulent mixing, the water column was stabilized by the intrusion of a warm Indian Ocean water mass by the Agulhas Current. (D. Husby, FTS (408) 646-3311)

TIBURON LABORATORY
Tiburon, California

UNDERUTILIZED FISHERIES RESOURCES INVESTIGATIONS

Biologists Learn about New Methods of Cooking and Preserving Fish in Asia

Fishery biologist Sus Kato recently returned from a trip to Japan and Taiwan from May 10-29. During his trip, Kato learned about methods of processing and preserving fish used by the Chinese and Japanese, and which he hopes to apply to U.S. fisheries.

One of the highlights of his trip was learning a new method of processing fish which softens the fish's hard parts. The fish are cooked under pressure at very high temperatures. Kato reported that the bones in a sample of sardines prepared this way were virtually undetectable. An 8-inch fish was headed and gutted and its tail removed before being immersed in an unspecified solution and treated in an autoclave. The fish was then rolled in bread crumbs and deep-fat fried. The flavor, smell, and texture were all excellent. Many small species such as shortbelly rockfish, may be suitable for this method.

Kato also learned of a methods of freezing tuna by immersion or spray-brine in a solution of calcium chloride ($CaC1_2$), rather than sodium chloride (NaCL). The method is especially useful for whole, thick-skinned fish such as albacore, which can be frozen quickly and efficiently at -40° in the $CAC1_2$ solution. Kato tasted sashimi made from skipjack frozen in $CaC1_2$ and found it excellent--similar to fresh skipjack. However, the color of the thawed, sliced flesh became rather dull and unappealing after 30-45 minutes of exposure to air. This method could be applied to several species in California fisheries, as refrigeration systems now used by vessels can properly attain -40° by using $CAC1_2$.

Another highlight of Kato's trip was discovering the potential for a fishery for slender tuna, Allothunnus fallai, in the Southern Hemisphere. Catch rates of Japanese experimental gillnetters were in the order of 10 tons per night of this species that was, until recently, relatively rare. The canned meat, packed in oil, is similar in taste and texture to albacore, but the color is a bit darker, though not as dark as the meat of yellowfin tuna. The fish are distributed primarily within 20° to 30° south latitude, almost across the Pacific Ocean and also in the Atlantic at similar latitudes. After a market has been established, perhaps the U.S. tuna fleet can target for this species.

Kato also found that ocean sunfish (Mola mola) is highly prized by many fishermen and sea-faring researchers. Unfortunately not many sunfish are caught; and those that are caught are quickly eaten at sea by the fishermen, so that they only rarely appear in fish markets. The meat and liver are prized mainly in northern Japan where the fish is more common, and the price for both meat and liver can reach $15/kg. The flesh is usually eaten as sashimi, and the liver serves as a base for the sauce used

with the raw fish. The liver is also cooked together with the flesh. The liver oil is used for topical application to help heal skin wounds, and is also taken in capsule form as a cure for gastrointestinal ulcers. The most surprising thing about sunfish is that the Taiwanese pay around $20/kg (ex-vessel) for the intestines. In fact, Taiwanese seem to favor the intestines and gonads of a number of species. Kato will definitely consider marketing the internal organs to develop the sunfish fishery in California.

Upon Kato's return from his Asian trip, he collected several small individuals of various rockfish and flatfish species, as well as some Pacific whiting, midshipmen, and lingcod from a commercial trawler in Monterey to try the Japanese method of softening the hard parts of fish. These fish were shipped to JAC Creative Foods, Inc., in Los Angeles, California, for preliminary testing as bone-softened food products. Kato reports that the tests showed that all the species could be treated successfully with this method. Further tests will be conducted to learn which species are most suitable, and the types of products that are most acceptable to American consumers.

Kato also obtained two 35 lb ocean sunfish (Mola mola) from San Pedro fisherman Matt May. The fish were processed, and the flesh given to two Bay Area restaurants and one processor. The yield of fillet was 20%, while the liver was 2.0% and the intestines 4.0%. A French chef prepared the liver of one fish as a mousse. This dish and a dish of poached sunfish flesh brought approving remarks from the president of Kikkoman Shoyu Company (Japan) who happened to be visiting. One cook (and part owner) of the second restaurant also liked the sunfish flesh, whether poached, steamed or sauteed. She especially liked the texture which she compared to shellfish. However, others sensed an unpleasant after-taste in the flesh, so, unlike the first restaurant, the second will not put sunfish on its menu at this time. The processor has agreed to try marketing sunfish if they are landed by fishermen this fall. (S. Kato, FTS 556-0565)

Tiburon Laboratory Represented at Trash Fish Banquet

On May 2, fishery biologist Bill Leet and librarian Maureen Woods attended a Trash Fish Banquet at the California Academy of Sciences' Steinhart Aquarium. Several hundred representatives from the fishing and processing industries and government agencies turned out to sample delicious preparations of underutilized species supplied by some of the participants. In addition to demonstrating the delectability of a variety of sea foods, the banquet promoted Marie De Santis' newly published book, "California Currents," which describes California's fisheries and their problems. The Tiburon Laboratory's culinary contribution was smoked skate wings, which received medium grades from samplers. (B. Leet, FTS 556-0565)

Vietnamese Fishermen's Association Seeks Help

Vitenamese fishermen are looking for alternatives to gillnetting and trammel netting for white croaker and halibut. Three meetings have been held between the staff members of the Underutilized Fisheries Resources Investigation and the Vietnamese Fishermen's Association of America, headed by Chieu Pham, to discuss ways of helping the fishermen. Many of the member fishermen appear interested in participating in trial applications of different gear, as well as in targeting on different (underutilized) species. Staff from the Tiburon Laboratory will aid the group by jointly testing several methods and by promoting the sale of the fishes. (B. Leet, FTS 556-0565)

GROUNDFISH ANALYSIS INVESTIGATION

Early Spawning Noted in Rockfish

Tiny Wyllie Echeverria, Fishery Biologist with the Groundfish Analysis Investigation of the Tiburon Laboratory, has been monitoring the extrusion of larvae by mature female rockfish (Sebastes) in northern and central California since 1981. The data were collected by the cooperative California Department of Fish and Game and National Marine Fisheries Service rockfish sampling program. For three of the principal species of Sebastes landed commercially in California, the reproductive pattern has varied considerably during the 5 years of observation. Through 1984, larval extrusion of Sebastes entomelas (Table 1) peaked in January and February; larval extrusion was lowest in December and March. For the 1985 season eyed larvae have been present over an extended period of time. Not only were they present earlier and later in previous years, but the peak period has been earlier and extends through the peak months of previous years. Similar patterns are seen in S. paucispinis (Table 2) and S. goodei (Table 3). This early spawning explains the early occurrence of juvenile rockfish noted in April off Mendocino by Dr. Edmund Hobson and Tony Chess of the Fish Communities Investigation and it explains their abundance in the midwater trawl landings during the April David Starr Jordan cruise DS-85-03 as noted by Peter Adams of the Investigation. The abundance of juveniles in April indicates at least that the early spawned fish have survived to the juvenile stage; the cruise planned for June (DS-85-05) to sample the abundance and distribution of juvenile rockfish between Point Sur and Cape Mendocino will determine whether later spawnings were also successful. (T.W. Echeverria, FTS 556-0565)

Table 1. Percent of mature female Sebastes entomelas containing larvae ready to be extruded. Sampled from commercial and sport landings.

Year	Nov	Dec	Jan	Feb	Mar	Apr
1981	0	0	24	28	2	0
1982	0	0	24	45	7	0
1983	0	0	11	6	0	0
1984	0	6	21	33	2	0
1985	7	29	28	25	8	4

Table 2. Percent of mature female Sebastes paucispinis containing larvae ready to be extruded. Sampled from commercial and sport landings.

Year	Dec	Jan	Feb	Mar	Apr
1981	0	11	14	8	4
1982	0	0	0	0	0
1983	0	5	1	21	13
1984	0	12	10	7	
1985	31	36	3	5	2

Table 3. Percent mature female Sebastes goodei containing larvae ready to be extruded. Sampled from commercial and sport landings.

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1981	0	2	16	39	22	29	0
1982	0	0	25	8	0	10	0
1983	0	0	41	23	42	14	0
1984	0	0	9	16	17	8	0
1985	1	5	41	50	15	9	1

Sablefish Sampling Plan Developed

Joseph Hightower, Fishery Biologist with the Groundfish Analysis Investigation of the Tiburon Laboratory, is developing a coastwide sampling plan for sablefish. He has completed a review of the literature on sablefish biology and management, and identified logistical problems that samplers might encounter from discussions with port biologists during a visit to four ports in California and Oregon. Using historical data provided by port biologists, he obtained preliminary variance estimates. These data were used to estimate the sampling effort needed to obtain acceptably precise estimates of the number of sablefish caught by sex and age class. Alternative estimates of required sample sizes were obtained by applying the results from the rockfish sampling program. These estimates are based on the assumption that the design of the sablefish sampling program might follow that of the rockfish program. Unfortunately, a substantial percentage of small sablefish are discarded and some sablefish are dressed at sea, so port sampling must be supplemented by at-sea sampling if all losses due to fishing are to be estimated accurately. The costs of at-sea sampling will be estimated and less costly alternatives will be identified and discussed in the final proposed sampling plan. The plan is due to be completed in September. (J. Hightower, FTS 556-0565)

PHYSIOLOGICAL ECOLOGY INVESTIGATION

Physiological Ecology of Groundfish Studied

A major objective of the Physiological Ecology Investigation is to determine spatial-temporal variability in the condition of adult rockfish and to determine the relationship between measures of physiological condition and the effective fecundity or reproductive capacity of the spawners. The long-term goal is to be able to relate the condition and reproductive capacity to the recruitment success and condition of recruits--that is, to forecast recruitment several years in advance.

Initial sampling has been done on four rockfish species: bocaccio (Sebastes paucispinis), chilipepper (S. goodei), widow rockfish (S. entomelas) and yellowtail rockfish (S. flavidus). These are among the most important species caught in the commercial fishery.

Dr. Bruce MacFarlane, Oceanographer, and Michael Bowers, Fishery Biologist, collected fish with hook and line off Bodega Bay and at Cordell Bank to obtain fresh specimens for examination of blood biochemistry (particularly lipids) and for histology of ovaries. Specimens were also collected from commercial trawl catches at Bodega Bay.

Approximately 75 fish have been measured, aged from otoliths, and examined for condition by Dr. Jeannette Whipple, Investigation Chief, and Pete Benville, Research Chemist. Subsamples were taken for proximate analysis of liver, gonad and muscle. Benville has completed proximate analyses of some samples.

Fishery biologist Maxwell Eldridge and Bowers subsampled ovaries for examination of eggs and larvae from both live material and histological sections. Special stains are being used to locate the sites of sperm storage in the female.

Whipple is analyzing the information to obtain initial results on variability in condition for the project review in July. General observations indicate that the fish are generally healthy, but there is some variability in the amount of mesenteric fat and lipid in the liver. The fish are generally not heavily parasitized, except occasionally bocaccio. Some yellowtail rockfish were found to have hearts affected by the parasitic protozoan Henneguya sebastoda. Dr. Michael Moser, Research Associate at Long Marine Laboratory at University of California Santa Cruz, has hypothesized that this parasite may retard growth and possibly reproduction at greater infection levels. Livers in some fish of all four species appear to bear lesions. Whipple plans to preserve the livers for further histological examination.

Results of initial data analyses will be reported later. (J. Whipple, FTS 556-0565)

FISH COMMUNITIES INVESTIGATION

1985 Continues to be a Strong Year for Many Species of Rockfish

A recent study by the Fish Communities Investigation confirms the earlier report (March-April Report of Activities) which predicted that 1985 would be a strong year for many species of coastal groundfishes. While scuba diving near Mendocino, investigation leader Dr. Edmund Hobson, fishery biologist Tony Chess, and biological technician Dan Howard observed large numbers of juvenile rockfishes (Figure 1) comparable to those they

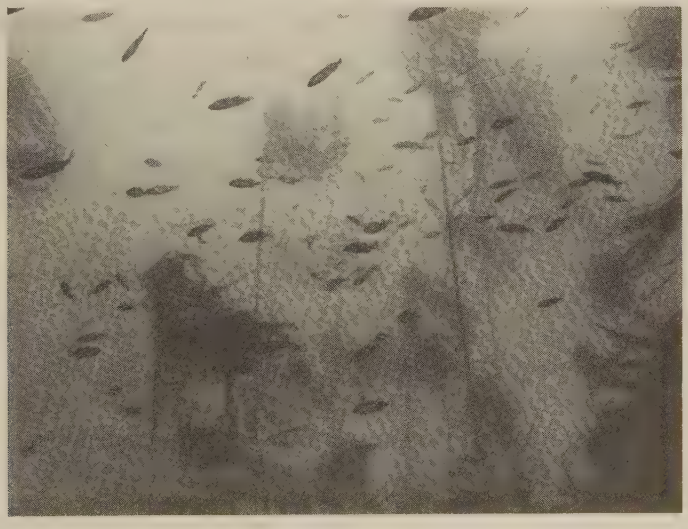

Figure 1. Juvenile rockfishes, Sebastes spp., amid growing bull kelp, Nereocystis, off the Mendocino coast during June, 1985.

found in 1977. During 1977, the strongest year class of many fish species was produced since observations began in 1975. Four species have dominated the crop of new rockfishes that appear along the Mendocino coast each spring: the blue rockfish, Sebastes mystinus, the black rockfish, S. melanops, the yellowtail rockfish, S. flavidus, and the canary rockfish, S. pinniger. The relative abundance of each species has varied from year to year. In 1977 the blue rockfish predominated over the yellowtail rockfish and the other species by ratios exceeding 10:1. This year, the yellowtail rockfish has predominated over the blue and the other species by ratios of about 4:1 or more.

A similar condition has been noted by Pete Adams, Leader of the June research cruise aboard the NOAA Ship David Starr Jordan in the Gulf of the Farallones. Working with fishery biologist Susan Smith and biological aid Wayne Samiere of the Fish Communities Investigation, Adams collected juvenile Sebastes spp. in numbers greatly exceeding those taken during the April 1985 cruise. During several 10-minute trawls 20,000 to 30,000 juvenile Sebastes were taken. One trawl took over 45,000. This compares to typical catches of 10 to 500 during the April cruise which, at the time, were the largest numbers that had been collected during the three years of sampling. Although the species composition of these catches is still being determined, preliminary data indicate that the yellowtail rockfish, along with the shortbelly rockfish (S. jordani), widow rockfish, (S. entomelas), and chilipepper (S. goodei), are the major species this year. The bocaccio (S. paucispinis) has not yet appeared in unusually larger numbers.

The data from Mendocino and the Gulf of the Farallones indicate that a year which favors a strong year class in one species of Sebastes will not necessarily favor a strong year class in another. This should be expected, considering that many of the various Sebastes species spawn during different months. Data from the fishery confirm that 1977 was a strong year class for widow rockfish and bocaccio, but not unusually so for yellowtail rockfish. This year, 1985, appears to be another strong year for the widow rockfish, and for the yellowtail rockfish as well, but not unusually so for the bocaccio.

The research cruise in June also provided data on the distribution of juvenile rockfishes. The standard sampling stations, where the large numbers of juveniles were taken, all are in less than 35 fathoms of water. A limited number of exploratory collections in deeper water (to 100 fathoms) took few or no juveniles. (E. Hobson, FTS 556-0565)

FISHERIES INFORMATION SYSTEMS & ADP

SWFC's Data Files to be Included in NEDRES System

The Southwest Fisheries Center has agreed to cooperate with the National Environmental Satellite Data and Information Services (NEDRES) in their plan to include NMFS in the NEDRES network. Network members, composed of private, academic, federal and state agencies, provide descriptions of their data files to the NEDRES data base in exchange for access rights. The database is a convenient and searchable system for a broad range of environmental data. Data element descriptions, geographic area of collection, and owners of the files, not the data values, reside in the database.

Mona Smith of NEDRES was at the SWFC in La Jolla, June 25-27 to conduct a input workshop on the NEDRES database where she briefly described the database design and information search/retrieval method. SWFC was selected as the pilot Fisheries Center for entering their files because it has an organized file inventory. (D. Roll, FTS 893-6250)

National Data Management Committee Makes Plans for the Future

Dorothy Roll, Supervisory Computer Systems Analyst, attended the National Data Management Committee meeting in the Northeast Fisheries Center, Woodshole, Massachusetts, on June 20 and 21. The participants discussed the Information Technology Plan for the 1995's (IT-95) and reviewed the Regional Data Base Administrator's system configuration design concept for the IT-95 system. A proposal under consideration is a large mainframe dedicated for NMFS with a computer in the VAX 780 class at each Center networked to the large mainframe. (D. Roll, FTS 893-6250)

ADMINISTRATIVE ACTIVITIES

Update on A-76 Study

Darrell Tidwell, Principal Reviewer for the A-76 Study, and Dean Brinker, NOAA visited La Jolla May 29 to 30, 1985, to conduct interviews and to begin the data collection process in preparation for the NMFS Management Efficiency Study (MES). Tidwell and Brinker's review replaces the A-76 study that was begun by Arthur Young and Co., in which each Center was to be considered separately. Under the new review, all NMFS data entry, computer operations, and systems programming for all of the Centers will be combined into a single MES.

During their visit, Tidwell and Brinker interviewed key ADP staff, La Jolla, and Honolulu to review the ADP positions at the Center and to determine the impact of NOAA's freezing of full-time permanent vacancies on ADP operations. This study is scheduled to be completed by October 1985.

On June 20 to 21, 1985, Dallas A. Carlson, NMFS, and Roger Sachse, NOAA, visited the Center to review administrative operations. This review results from the current Department of Commerce and NOAA review of field administrative support positions. Carlson and Sachse are part of a NOAA team charged with reviewing NMFS field activities to determine if field administrative work duplicates support received from the Regional Administrative Support Centers.

They will provide recommendations, based on their review, to lift the current freeze on filling administrative positions in the field. The team also interviewed Ron Scheltens, Executive Officer at the Southwest Region, regarding Regional Office administrative operations.

The review is scheduled to be completed by August 1985. (B. Remington, FTS 893-62480

MISCELLANEOUS

Students Win NOAA Junior Fellowships

Finding a summer job isn't a problem for Marissa Schwartz and Darlene Pickett, both 18. Schwartz and Pickett are the recipients of the 1985 NOAA Junior Fellowship awards at the National Marine Fisheries Service, Southwest Fisheries Center in La Jolla, California. The award guarantees the new Fellows full-time, on-the-job work experience in marine sciences research during their vacations and part-time work during the school year. Upon their graduation from college, they are eligible for positions with NOAA without further competition.

Schwartz is a 1985 graduate of the La Jolla Country Day School where she distinguished herself as the Senior Class President, varsity cross-country and track team member, a member of the Student Council, and in the top 5% of her class. She will enter Stanford University this fall.

At the Center Schwartz will be working with Dr. Pierre Kleiber, a systems analyst who is developing an albacore model in order to investigate a variety of theoretical questions concerning the albacore population in the North Pacific and the fisheries that depend on this population. With a strong interest in mathematics and biology, Schwartz's first job is to learn how to program a computer. In a break from her programming duties, Schwartz recently returned from a 5-day trip aboard the NOAA research vessel, David Starr Jordan, where she helped biologists track sea lions.

Pickett is an honor graduate from Santana High School in Santee, California, where she was a member of the California Scholarship Federation, mentioned in Who's Who in American High Schools, and the recipient of a commendation from the National Merit Scholarship program. An avid swimmer and diver, Pickett is also an enthusiastic photographer, receiving a photography award at the recent Southern California Exposition. In the fall she will attend Humboldt State University in Arcata, California.

NOAAs Junior Fellows Marissa Schwartz (left) and Darlene Pickett (right) at work.

At the Center Pickett is working with John Butler, a fishery biologist who is ageing fish larvae using daily increments as laid down in the ear bones (otoliths) of the animal. The program, the largest in the Coastal Fisheries Resources Division at La Jolla, provides information used for assessment of fish populations and the management of pelagic fish stocks, such as the northern anchovy of California.

Schwartz and Pickett are the latest recipients of the NOAA Junior Fellowships, a program which began at the Southwest Fisheries Center in 1972. Presently, there are six other Junior Fellows at the Center's four laboratories.

National Safe Boating Week Observed

The Southwest Fisheries Center helped celebrate National Safe Boating Week in San Diego. Ken Raymond, Illustrator, and Geoffrey Moser, Fishery Biologist, manned an exhibit of coastal fisheries research at the celebration, which was held on June 1. The U.S. Coast Guard Auxiliary sponsored the event, which over 50,000 people visited.

Figure 1. Geoffrey Moser points out larvae to visitors.

Figure 2. Also representing NOAA at the open house were Nelson Ross (left) of National Environmental Satellite Data and Information Services, Steve Cook (center) of National Ocean Services, and Wilbur Shigehara (right) of the National Weather Service.

PUBLIC AFFAIRS

Honolulu Laboratory

May 2 - A class from the Kailua High School Community Quest Program in earth sciences visited the Laboratory. Dr. George Boehlert spoke to the students on the Laboratory research programs and on the potential effects of OTEC development on Hawaii's marine environment by Dr. Harrison.

June 5 - Dr. Stephen Ralston presented a seminar, "The Status of Hawaii's Opakapaka in 1984," at a meeting of the Hawaii Chapter of the American Fisheries Society in the Honolulu Laboratory seminar room.

La Jolla Laboratory

On May 6, 1985, Dr. Albert Myrick spoke to a 10th grade class at Morse High School on cetaceans and cetacean research.

Tiburon Laboratory

May 2 - The Underutilized Fisheries Resources Investigation of the Tiburon Laboratory participated in a "Trash Fish Banquet" sponsored by the Steinhart Aquarium, California Academy of Sciences.

27 - Sus Kato was featured in a 4-page article in the May 27 issue of People, which focused on his efforts to develop underutilized fisheries resources.

29 - Jeannette Whipple appeared on the KQED-TV (PBS) program "Express", as part of a special on the pollution problems of the Kesterson Reservoir and San Francisco Bay.

PRESS RELEASE

Tiburon Laboratory

May 3 - "Biologists Find Marine Life Is Abundant After End of El Niño."

SEMINARS

Honolulu Laboratory

May 1 - William G. Gilmartin, Leader, Marine Mammals and Endangered Species Program, spoke on "The Study of the Hawaiian Monk Seal."

June 19 - Dr. Robert A. Skillman spoke on "Review of the Northwestern Hawaiian Islands Lobster Fishery."

21 - Rhys Brown and Nick Caputi, Department of Fisheries and Wildlife, Western Australian Marine Research Laboratory, spoke on "The Austraulian Rock Lobster Fishery and Associated Research."

La Jolla Laboratory

June 18 - Professor F. James Rohlf, Department of Ecology and Evolution, State University of New York at Stony Brook, spoke on "Analysis of differences among two-dimensional outlines."

HONORS AND AWARDS

Honolulu Laboratory

Dr. Richard Brill was notified by Dr. G. Causey Whittow (Department Chairman) that he has been appointed to the Affiliate Graduate Faculty of the Department of Physiology, John A. Burns School of Medicine, University of Hawaii.

Dr. Brill has also been notified by Dr. William Bayliff (IATTC) that he has been appointed a member of the FAO Working Party on Tuna and Billfish Tagging.

Tiburon Laboratory

June 19 - Director Norman Abramson presented awards for Sustained Superior Performance to Walburga Giguere, Catherine Hurst, Norma Smith, and David Woodbury.

VISITORS

Honolulu Laboratory

May 22 - David McAtamne, shrimp fisherman and marketer, North Queensland.

3 - Albert Caton, Australian Fisheries Service, Department of Primary Industries, Canberra, Australia.

20 - Dr. Marsh Youngbluth, Harbor Branch Foundation, visited Dr. Boehlert to discuss seamount research, and in particular, submersible research.

21 - Rhys Brown and Nick Caputi, Australia.

25-26 - Dr. Izadore Barrett, John Carr, and Dave Mackett, SWFC, and A.D. Parsons, Washington, DC, participated in the program review.

La Jolla Laboratory

May 14 - Mlle. Marie-Annic Martin-Sane, First Vice-Chairman of the Intergovernmental Oceanographic Commission, Ministere des Relations Exterieures, Paris, France, visited the Center and met with Reuben Lasker.

28 - Six Chinese scientists from the Shanghai Fisheries College, Shanghai, China, visited the Center.

- Bob Siegel, Economist with Policy and Planning, Washington, DC, began his rotational assignment in La Jolla.

29 - Darrell Tidwell and Dean Brinker came to the Center to review SWFC ADP operations for A-76.

30 - Dave McConaghy, new Commanding Officer of the Townsend Cromwell visited the Center.

June 6-7 - Mike Fraser, Policy and Planning, Washington, DC, met with Dave Mackett.

11-12 - Dr. Joseph Angelovic, Deputy Assistant Administrator for Science and Technology, NMFS, Washington, DC, participated in the Oceanic Division Program Reviews.

19 - Mr. Rosner, Federal Republic of Germany, met with Izadore Barrett.

20-21 - Bob Pedrick and Ed Pastula, NMFS, Office of Resource Investigations, Washington, DC, and Gary Smith, Southwest Regional Office, Terminal Island, California, attended

Coastal Fisheries Resources Division Program reviews at the Center.

- Tex Carlson, Roger Sachse and Ron Sheltens visited the Center to participate in the NOAA Administrative Position Reviews.

Pacific Fisheries Environmental Group

May 7 - Ron Lynn, SWFC, Dr. Jim Simpson, SIO, and Sig Larson of Mineral Management Service visited PFEG.

13-14 - Dr. Alistair Gilmour, Professor of Environmental Studies, Macquarie University, Australia, visited with members of the PFEG staff to discuss environmental data.

23 - Dr. Don Hansen of the ERL Atlantic Oceanographic and Meteorological Laboratory visited Doug McLain and PFEG. Dr. Hansen is head of the physical oceanographic group at AMOL in Miami and was in Monterey this week for the Pacific Climate Workshop at Asilomar.

June 5 - Dr. Liz Francis, Department of Biology, Bates University, Lewistown, Maine, gave a seminar on Velella (purple sailor).

- Dave McB. Williams of the Australian Institute of Marine Science visited PFEG to discuss tropical demersal systems and nearshore transport.

- Gary Sharp, consultant to FAO, visited PFEG to discuss the availability of environmental data.

6 - Sus Kato of the Tiburon Laboratory passed by the Hopkins Marine Station offices for an informal visit. He had with him Mr. Okato from Los Angeles who is a food procesing specialist.

21 - Mr. Hansen and Mr. Johnson of the San Francisco district I.G. office paid a visit to PFEG. Acting Chief Dick Parrish explained the PFEG program.

Tiburon Laboratory

May 23 - Carroll McCutcheon and Patty Druce, WASC Personnel, Seattle, Washington, discussed results of the WASC Personnel Organizational Assistance Review conducted in April with Norman Abramson and Wally Giguere.

7 - Dr. Minoru Okada, Technical Advisor to JAC Creative Foods, Los Angeles, California, discussed a Saltonstall-Kennedy proposal to soften fish bones during processing with Sus Kato.

11 - Dr. David Williams, Australian Institute of Marine Science, Townsville, Queensland, met with Edmund Hobson to discuss fish community studies.

12 - Lee Anderson, IPA NMFS/University of Delaware, visited Edward Ueber.

- Kristine Hagemeyer de Sanchez, Norgaard Consultants, visited Edward Ueber.

13 - Susan Andres Neely, Royal Iceland, Bverkeley, California, visited Sus Kato.

MEETINGS AND TRAVEL

36th Annual Tuna Conference Held

The 36th Annual Tuna Conference, hosted by the Inter-American Tropical Tuna Commission, (IATTC), was held at the University of California Conference Center, Lake Arrowhead, California, from May 21 to 24, 1985. The Tuna Conference, which has been an annual event since 1950, provides biologists with an opportunity to meet and exchange information on current research on tuna and tuna-like species.

This year Kurt Schaefer, Associate Scientist at the IATTC, chaired a most successful conference. This year's presentations focused on the three essential and continuously current topics of distribution, abundance, and movements. Presentations about research on other topics related to tuna were also presented. There were 73 participants, with representatives from Australia, the Azores, Canada, Indonesia, Japan, Mexico, and the Seychelles.

The presentations were organized into four sessions: distribution, abundance, movements, and other aspects. Dr. Bruce Collete, Systematics Laboratory, NMFS, Washington, DC, convened the session on distribution; Paul Sund, PFEG, presented "Tuna distribution in relation to the environment;" Dr. Richard Brill, Honolulu Laboratory, presented "Physiological factors affecting tuna distribution and movements;" Dr. Steve Reilly, OFRD, presented "Spatial temporal patterns in ETP dolphin distribution from tuna vessel observer data;" Dr. David Au, OFRD, discussed "Avifauna of eastern Pacific tunas."

Dr. Robert Francis, Northwest Fisheries Center, convened the session on abundance. During that session, Dr. Tim Smith, OFRD, presented "A heuristic data analysis device for examining spatial-temporal patterns." Smith discussed the potential for using micro-computers for graphically displaying fine scale aspects of tuna purse seiner searching strategies.

Dr. Robert Kearney, IATTC, convened the session on movements. In that session, Dr. Michael Laurs, CFRD, gave an overview on albacore movements throughout the Pacific Ocean, in a talk entitled "Large-scale and small-scale movements of albacore." Drs. Pierre Kleiber, OFRD, and Sam Bledsoe,

University of Washington, presented "Behavior of albacore population dynamics and movement model." Dr. John Hunter, CFRD, gave an overview of the workshops he has recently chaired on tuna movements and distribution in a talk entitled, "Future directions for research on the dynamics of tuna movement."

Dr. Christofer Boggs, Honolulu Laboratory, was the convener for the session on other aspects. In that session Boggs presented, "A physiological index for natural mortality;" Dr. Elizabeth Vetter, OFRD, presented "Running hot and cold in the ETP: some simple hypothesis about origin and poersistence of the tuna-dolphin association;" Dr. Richard Brill, Honolulu Laboratory, presented "Description pf a newly rediscovered parasite from the dorsal aorta of yellowfin tuna Thunnus albacares;" Paul Sund, PFEG, presented, "A wind fishability index for albacore;" Dr. Jay Barlow and Stephanie Sexton, OFRD, presented, "Geographic variation in spotted dolhin reproduction parameters."

The conference closed with a business meeting during which Dr. Richard Brill of the SWFC was appointed next year's Chair.

Abstracts of all the talks will be published and distributed to participants; copies will also be made available to other interested individuals on request to Kurt Schaefer, IATTC. (K. Schaefer, FTS 893-6820)

Honolulu Laboratory

May 2-3 - Dr. Skillman and Samuel G. Pooley, Industry Economist, participated in the 34th meeting of the Scientific and Statistical Committee of the Western Pacific Regional Fishery Management Council (Council) in the Honolulu Laboratory conference room.

7-8 - Richard Shomura and Dave Hamm participated in the 49th Council meeting in Saipan and Guam. Dr. Polovina and Robert B. Moffitt, Fishery Biologist, presented results of the 5-year assessment of deepwater bottomfish and shrimp resources around the Mariana Archipelago and an overview of the tuna fishery in the western Pacific at workshops held in conjunction with the Council meetings.

9-12 - Jerry Uchiyama attended the International Symposium on Age and Growth of Fish at Des Moines, Iowa. The symposium was sponsored by the Fisheries Department of Iowa State University and was a tribute paid to Dr. Kenneth D. Carlander who is retiring next month.

16 - Dr. Boehlert attended the meeting of the Coordinating Council for Research on Seafloor Processes at the University of Hawaii.

20-24 - Richard Shomura attended a meeting of the SWFC Directorate and Laboratory-Division Leaders, and he attended the Tuna Conference at Lake Arrowhead, California.

May 22-June 15 - Dr. Boehlert traveled to Japan where he visited the University of Tokyo, the Ocean Research Institute, University of Kyoto, the University of Hokkaido, the Hokkaido Institute of Mariculture, the Tohoku Regional Fisheries Research Laboratory, and Tohoku University. The trip was made under the auspices of the NSF sponsored U.S.-Japan Cooperative Science Program. Most of the time was spent conducting research in Shikabe and Hakodate, Hokkaido, on reproduction in Sebastes. Dr. Boehlert presented two seminars during his stay in Japan.

May 29 - Richard Shomura departed Honolulu for meetings in Bangkok and Sri Lanka.

La Jolla Laboratory

May 4-7 - Ron Lynn attended a Dynalysis Review of Minerals Management Service Contract in Monterey, California.

6-7 - Director Izadore Barrett traveled to Miami, Florida, to meet with Joseph Angelovic and Dick Berry.

7 - Reuben Lasker participated in the selection of a Director for the Aquaculture and Fisheries Department at the University of California, Davis.

13-15 - Izadore Barrett and Dan Huppert traveled to Portland, Oregon, to attend a joint meeting of the Pacific Council's Groundfish Management Team and SSC.

20-22 - James Squire traveled to Los Cabos, Buena Vista, and Cabo San Lucas, Mexico, to contact tagging cooperators and make annual Gardiner Foundation Tagging Awards.

21-24 - David Au, Jay Barlow, Norm Bartoo, Izadore Barrett, John Carr, Susan Chivers, Al Coan, Andy Dizon, David Holts, John Hunter, Al Jackson, Pierre Kleiber, Michael Laurs, David Mackett, Jean Michalski, Steve Reilly, Stephanie Sexton, Tim Smith, and Elizabeth Vetter attended the 36th Annual Tuna Conference at Lake Arrowhead, California.

28-31 - Chuck Oliver went to Seattle, Washington, to conduct analysis of pinniped tag/resight data at the National Marine Mammal Laboratory.

May 30-June 10 - Michael Laurs presented an invited paper on satellite applications to fisheries in the U.S. at the International Symposium on Ocean Space Utilization - Ocean Space '85, at Tokyo, Japan.

June 3-4 - Izadore Barrett traveled to Washington, DC, to meet with Bob Eisenbud, Senate Commerce Committee, about dolphin monitoring.

3-5 - William Perrin went to Los Angeles, California, to attend a meeting called by Zoological Society of Chicago, and AAZPA to advise on increasing circulation and dissemination of marine mammal technical information.

7-10 - William Perrin and Jeanne Wexler went to San Clemente Island, California, to obtain pup counts and tag resighting of pinnipeds.

9-13 - Dave Mackett attended an NMFS Planner's Conference in Washington, DC.

10-13 - Dan Huppert traveled to Portland, Oregon, to attend a meeting of the Pacific Coast Fisheries Data Committee and he traveled to Seattle, Washington, to meet with Natural Resources Consultants, Inc., personnel about contract matters.

19-22 - Dorothy Roll attended a National Data Management Committee Meeting in Woodshole, Massachusetts.

- Steve Reilly and Pierre Kleiber traveled to San Luis Obispo, California, to attend a Pacific Coast Modeling Conference.

23-26 - Steve Reilly and Tim Smith traveled to Narrangansett, Rhode Island, to attend an NMFS planning meeting for participation in Antarctic research.

24-27 - Izadore Barrett traveled to Honolulu, Hawaii, to conduct Honolulu Laboratory Program Reviews.

24-28 - John Carr went to Honolulu, Hawaii, to conduct Honolulu Laboratory Program Reviews.

24-30 - Dave Mackett traveled to Honolulu, Hawaii, to conduct Honolulu Laboratory Program Reviews and to facilitate a meeting on fisheries habitat research.

May 27-
June 20 - William Perrin traveled to Bournemouth, England, to participate in a meeting of the Scientific Committee of the International Whaling Commission.

Pacific Fisheries Environmental Group

April 30-
May 3 - Doug McLain was in Washington, DC, to meet with staff from NODC, NMFS, and NOS. On May 2 and 3 he participated in a review panel for EPOCS (Eastern Pacific Oceans Climate Study).

May 14 - Andy Bakun traveled to La Jolla, California, to meet with First Vice-Chairman of IOC, M.A. Martin-Sane.

14-17 - Dick Parrish attended the North Pacific Albacore Workshop.

20-21 - Andy Bakun was in La Jolla, California, for a Center Management Meeting.

20-24 - Dick Parrish, Doug McLain and Jerry Norton attended the Pacific Climate Workshop at Asilomar Conference Grounds. Parrish was named Chairman of the Biological Sub-panel and Jerry Norton spoke on El Niño effects. The conference was sponsored by the U.S. Geological Survey.

21-24 - Paul Sund attended the Tuna Conference at Lake Arrowhead, California. He presented a panel paper on Tuna Distribution and the Environment. He also presented "A wind fishability index for albacore."

28 - Doug McLain traveled to Menlo Park, California, to meet with employees of California Department of Fish and Game.

31 - Paul Sund met with Dr. Jim Watanabe, Monterey Bay Aquarium and Mr. Jim Hardwick, California Department of Fish and Game to discuss a proposal for use of a submersible in a study of the reproductive behavior and related ecological factors of the squid, Loligo opalescens, in Monterey Bay.

June 10-11 - Dick Parrish traveled to La Jolla, California, to attend an Albacore Budget Review meeting.

10-14 - Andy Bakun was in the Faroe Islands. On June 12 he gave a talk entitled "Fish larvae survival and timing of crucial environmental processes in the California Current and similar eastern boundary current systems."

11-14 - Dave Husby traveled to La Jolla, California, to attend a SARP meeting and also visit the R/V Melville before it sails. Dave will be joining the Melville in March 1986 to go to the Antarctic.

14 - Dick Parrish traveled to Santa Cruz, California, to meet with Liz Francis to discuss ocean circulation and Velella.

- Rosemary Trolan traveled to San Francisco, California, to attend an OPM class on the Civil Service Spouse Equity Act which went into effect May 7, 1985.

24-30 - Andy Bakun attended (as OSLR Chairman) planning discussions on OSLR-IREP Program on squid recruitment variability in Banyuls-sur-mer, France.

Tiburon Laboratory

May 10-29 - Sus Kato traveled to Japan and Taiwan to investigate fishing, handling, processing, and marketing methods applicable to U.S. fisheries.

14-15 - Norman Abramson and William Lenarz attended a joint meeting of the PFMC's Groundfish Management Team and Scientific and Statistical Committee in Portland, Oregon. Groundfish research needs were discussed.

20-21 - Norman Abramson attended a meeting of the Southwest Fisheries Center's Laboratory Directors and Division Chiefs at La Jolla, California.

- Edward Ueber took part in the International Edible Crab Workshop at Fort Funston in San Francisco, California. The workshop provided an update on the current status of research and the industry, and featured a discussion of the best management procedures to implement when a new crab fishery has begun. Ueber organized the workshop, which was partially funded by Sea Grant.

June 6 - Candis Cooperrider attended the San Diego meeting of the Marine Recreational Fishery Statistical Survey meeting.

- Edward Ueber attended an economists' meeting in La Jolla, California.

13 - Norman Abramson attended a meeting of the Pacific Coast Fisheries Data Committee in Seattle, Washington.

18-20 - Joseph Hightower attended the meeting of the Canadian-U.S. Technical Subcommittee of the International Groundfish Committee in Juneau, Alaska.

25-29 - Edmund Hobson attended a habitat study workshop in Hawaii.

PERSONNEL ACTIONS

Honolulu Laboratory

May 1 - Matthew T. Wilson, Biological Aid (Fisheries) - Full-Time Temporary Appointment.

10 - Ellen S. Hayakawa, Computer Clerk - Termination - Expiration of Appointment.

12 - Alan R. Everson, Biological Technician (Fisheries) - Conversion to Career-Conditional Appointment.

13 - Rodney T. Watson, Biological Technician (Fisheries) - Extension of Temporary Appointment.

15 - Jed Hirota, Fishery Biologist (Research) - Temporary Excepted Appointment (Faculty Fellowship).

23 - Theresa L.M. Villanueva, Biological Science Student Trainee (NOAA Junior Fellow) - Return to Duty.

26 - Robert H. Humphreys, Jr., Fishery Biologist (Research) - Reassignment.

- Theresa L.M. Villanueva, Biological Science Student Trainee (NOAA Junior Fellow) - Promotion.

June 1 - Gary D. Stephens, Computer Programmer - Conversion to Part-Time Temporary Appointment.

3 - Miriam B. Pillos, Biological Science Student Trainee (NOAA Junior Fellow) - Return to Duty.

9 - Todd T. Kassman, Computer Programmer - Conversion to Excepted Part-Time Appointment.

- Miriam B. Pillos, Biological Science Student Trainee (NOAA Junior Fellow) - Promotion.

- Gail A. Pelterson, Biological Technician (Wildlife) - Full-Time Temporary Assignment.

13 - John A. Loux, Biological Aid (Fisheries) - Extension of Part-Time Temporary Appointment.

14 - Jed Hirota, Fishery Biologist (Research) - Termination - Expiration of Excepted Appointment).

- Yara L. Lamadrid-Rose, Biological Technician (Fisheries) - Resignation.

17 - Linda L. Hudgins, Industry Economist - Temporary Excepted Appointment (Faculty Fellowship).

La Jolla Laboratory

May 6 - James Payne, Computer Clerk - Entered on Duty.

10 - Larry Wyckoff, Biological Technician - Resignation.

- Dennis Gruber, Biological Aid - Resignation.

12 - Anthony Sarian, Computer Assistant - Resignation.

13 - Todd Clopine, Computer Assistant - Entered on Duty.

- Raymond Young, Computer Assistant - Entered on Duty.

- Robert Holland, Computer Clerk - Entered on Duty.

26 - Anne Mahan, Clerk - Entered on Duty.

June 7 - George Lundy, Editorial Assistant - Resignation.

24 - Darlene Pickett, Biological Science Student Trainee (1985 Junior Fellow) - Entered on Duty.

26 - Marissa Schwartz, Biological Science Student Trainee (1985 Junior Fellow) - Entered on Duty.

Pacific Fisheries Environmental Group

June 11 - Kristen Baird reported to work. She is working as a biological aide for the summer.

Tiburon Laboratory

May 27 - Susan J. Daves, Clerk-Typist - Termination of Appointment (Resignation).

La Jolla Laboratory

New employees at the La Jolla Laboratory are Richard Lindsay (left), biological technician with the Oceanic Fisheries Resources Division who began work on April 14. Peter Stangl (right) is a NOAA Corps Officer who has been assigned to the SWFC for 3 years.

STATUS OF PUBLICATIONS

Published

Boehlert, G. W. and J. B. Morgan. 1985. Turbidity enhances feeding abilities of larval Pacific herring, Clupea harengus pallasi. Hydrobiologia 123:161-170.

Echeverria, Tina and William H. Lenarz. 1984. Conversions between total, fork, and standard lengths in 35 species of Sebastes from California. Fish. Bull., U.S. 82:249-251.

Hightower, J. E. and G. D. Grossman. 1985. Comparison of constant effort harvest policies for fish stocks with variable recruitment. Can J. Fish. Aquat. Sci. 42:982-988.

Environmental variability may have a substantial influence on marine fish stocks, primarily by affecting survival to the time of recruitment. Simulation studies at low, intermediate, and high levels of variability in recruitment were used to compare alternative constant effort policies for anchovy (Engraulis capensis), Atlantic menhaden (Brevoortia tyrannus), and Pacific ocean perch (Sebastes alutus) fisheries. These policies were either to maintain effort at the level producing maximum sustainable yield (f_{MSY}), or to permit levels of effort 25-100% greater than f_{MSY}. An increase of effort above 25% f_{MSY} typically did not reduce annual yield significantly; however, a significant reduction in yield was apparent in all cases when effort increased by 75-100%. When recruitment is highly variable, comparable yields may be obtained at several levels of fishing effort. In such cases, environmental variability provides the fishery manager with considerable flexibility to enhance social or economic benefits without decreasing yields significantly.

Perry, S. F., C. Daxboeck, B. Emmett, P. W. Hochachka, and R. W. Brill. 1985. Effects of temperature change on acid-base regulation in skipjack tuna (Katsuwonus pelamis) blood. Comp. Biochem. Physiol. 81A:49-53.

Polovina, J. J. 1984. An overview of the ECOPATH model. ICLARM Fishbyte 2(2):5-7.

Parrish, Richard H. 1985. Operational plan for NMFS albacore program. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFC-52, 31 p.

Sund, Paul N. 1985. Albacore fishing and windspeed. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFC-53, 18 p.

Zug, G. R. and G. H. Balazs. 1985. Skeletochronological age estimates for Hawaiian green turtles. Mar. Turtle Newsl. 33:9-10.

Approved by Center Director

Balazs, George H. and William G. Gilmartin. A suggested modification of tagging pliers. Mar. Turtle Newsl.

Boehlert, George W. Seamount resources: Hypotheses and future research directions. U.S. Dep. Commer., NOAA Tech. Rep. NMFS.

Fiedler, Paul C., Roger P. Hewitt, and R. D. Methot. Effects of California El Niño 1982-1984 on the northern anchovy. For consideration for publication in the Journal of Marine Research.

Genin, Amatzia and George W. Boehlert. Dynamics of temperature and chlorophyll structures above a seamount: An oceanic experiment. Journal of Marine Research.

Humphreys, Robert L., Jr. and Darryl T. Talgami. Review and current status of research on the biology and ecology of pelagic armorhead. U.S. Dep. Commer., NOAA Tech. Rep. NMFS.

Jones, David R., Richard W. Brill, and Dennis C. Nense. The influence of blood gas properties on gas tensions and pH of ventral and dorsal aortic blood in free swimming tuna (Euthynnus affinis). Journal of Experimental Biology.

Leet, William S., Roger E. Green, and Daniel Ralph. Pen rearing Pacific salmon (Oncorhynchus spp.) in San Francisco Bay for increasing ocean harvest. For consideration for publication in Marine Fisheries Review.

Seki, Michael P. and Darryl T. Tagami. Review and present status of handline and bottom longline fisheries for alfonsin. U.S. Dep. Commer., NOAA Tech. Rep. NMFS.

Shomura, Richard S. Seamounts: A biological concourse in the open sea. An introductory statement. U.S. Dep. Commer., NOAA Tech. Rep. MFS.

Song, Y. C., R. J. Ratty, and R. M. Laurs. Transmission electron microscope for observation of C-banded skipjack tuna chromosomes. For consideration for publication in the Journal of Fish Biology.

Squire, James L., Jr. Striped marlin (Tetraptures audax) migration patterns and rates in the northeast Pacific Ocean: Their relation to resource management. For consideration for publication in Special Scientific Report--Fisheries.

Uchida, Richard N. and Sigeiti Hayasi. Foreword and six Session Summaries. U.S. Dep. Commer., NOAA Tech. Rep. NMFS.

Vetter, Elizabeth F. Allometry energetics parameters in spotted dolphins. For consideration for publication in Marine Mammal Science.

Wetherall, Jerry A. and Marian Y. Y. Yong. Problems in assessing the pelagic armorhead stock on the central North Pacific seamounts. U.S. Dep. Commer., NOAA Tech. Rep. NMFS.

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